KENTUCKY'S MINERAL RESOURCES

By
WILLARD ROUSE JILLSON
Director and State Geologist

CALIFORNIA STATE MINING BUREAU
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KENTUCKY GEOLOGICAL SURVEY
FRANKFORT, KENTUCKY
1927

The

Kentucky Geological Survey

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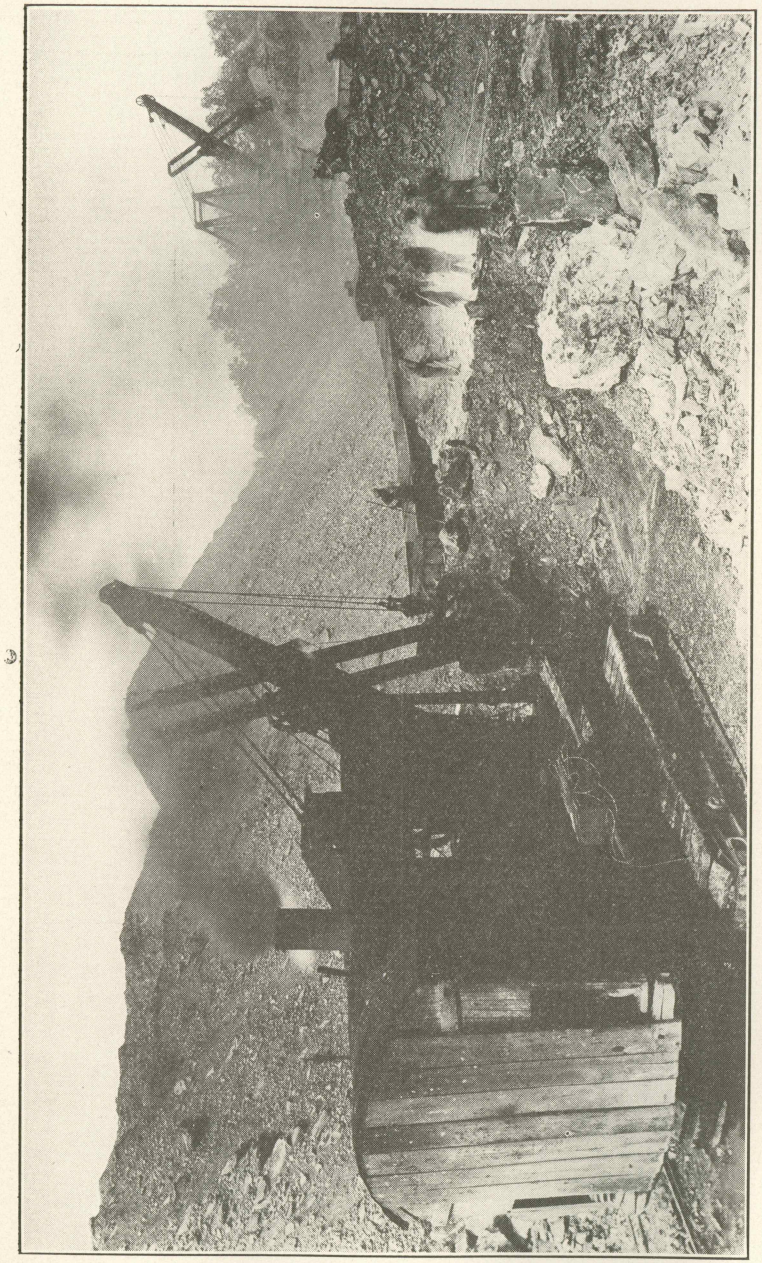
Director and State Geologist

SERIES VI
PAMPHLET XIII

Kentucky's Mineral Resources

1927



OPEN PIT COAL MINING

Within recent years a number of coal operations of this character have been undertaken in Western Kentucky. No. 12 coal four feet in thickness is being operated here in Hopkins County, Kentucky.

KENTUCKY'S MINERAL RESOURCES

A brief geologic and geographic Review, coupled with Summary Statistics of Production.

By

WILLARD ROUSE JILLSON

Director and State Geologist
and
Curator Kentucky State Museum

Thirty-seven Photographic Illustrations and Mineral Index Maps of Kentucky

KENTUCKY GEOLOGICAL SURVEY
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1927

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KENTUCKY'S MINERAL RESOURCES

By WILLARD ROUSE JILLSON, SC. D.,

Few areas of similar size in America or the world have been as richly endowed with natural and mineral resource wealth as the State of Kentucky. Throughout all of its broad and delightful domain of 40,598 square miles stretching from the Cumberland Mountains westward to the Mississippi there is hardly any extended part of the Commonwealth that does not contain both developed and undeveloped mineral wealth of great potential value. For upwards of a century or more it has been common practice on the part of many Kentuckians, cognizant and proud of their natural heritage, to speak in large terms of the undeveloped natural and mineral wealth of the State. Though much has been said in such a manner and a great deal in truth has been written o nthis subject, it is nevertheless probably a fact that the enormous natural wealth of this Commonwealth has been considerably underestimated and is still underappreciated.

The first geological reconnaissance of Kentucky was conducted by Dr. William Williams Mather upon executive order in 1838. He listed a large number of the important mineral resources of the State, and designated in general terms their location within the boundaries of Kentucky. Subsequent investigations of a more or less detailed nature by six official Geological Surveys of Kentucky have served to augment the number of mineral resources until at the present time a very imposing list of about 38 separate and distinct resources are now known to be available in Kentucky. Not all of these, however, are found in this State in commercial quantities. The commercial minerals existing in suitable quality and quantity to meet present day competition are confined to a restricted list of about twenty-five.

It will probably come as a matter of a surprise to many who assume familarity with conditions in Kentucky to know that this State stands first in the United States and the world in the production of two very important minerals, fluorspar and native asphalt. In 1926, Kentucky for the first time in her history

KENTUCKY ROCK ASPHALT

Open pits such as this one on Beaver Dam Creek in Western Edmonson County are made in prospecting a property. Note how the sun has caused the sandstone to bleed liquid asphalt. Kentucky now produces more rock asphalt than any other state in this country.

produced 62,495 tons of flourspar valued at $1,167,129.00. In the same year this State increased its production over 1925 when it produced 286,850 tons of rock asphalt valued at $2,500,000.00. In as much as the largest ultimate reserves of these minerals in the Eastern United States immediately available to transportation and large consumption are located in Kentucky, there is no reason to assume that the lead now taken by this State will be lost in the near future.

Of immensely greater value, however, than either the fluorspar or asphalt resources, the coal deposits of Kentucky estimated to contain approximately 125,000,000,000 tons in the ground, are easily the largest mineral resource of the State. During the year 1925, Kentucky stood fourth in the United States and America as a producer of coal, 54,687,932 tons being mined to which a valuation of $89,404,450.00 has been given.

The petroleum resources of Kentucky have assumed major significance within the last twenty years. During 1925 there were produced in this State 6,658,803 barrels of crude oil which was valued at $15,290,167.00. One small mountain county, Lee, containing the Big Sinking pool and producing from the Corniferous (Devonian) "sand," has to its credit over 25,000,000 barrels of petroleum since 1918. According to recent calculations Kentucky occupies 9th place in the United States in the production of petroleum.

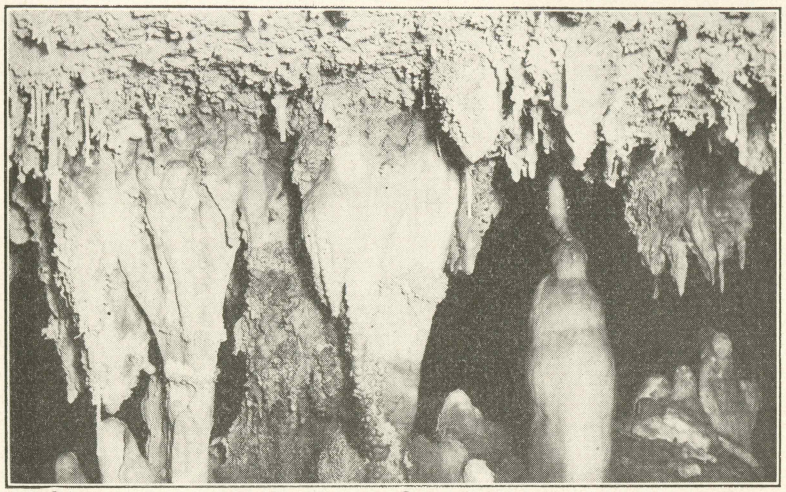
The commercially important natural and mineral resources of Kentucky may be briefly listed and described as follows:

Abrasives:

Sandstones, sand and fine gravels suitable for use as abrasives are found in large quantity and excellent quality near rail and water transportation both in Eastern and Western Kentucky. The abrasive industry of this State, however, is not nearly as large as it might be. Hones are made at Elizabethtown.

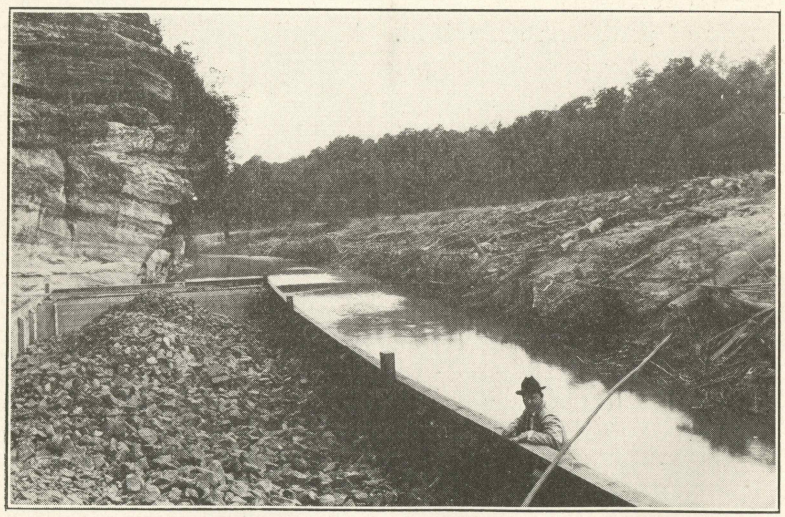
Aragonite:

This beautiful stone, formed by the slow accumulation of mineral from evaporating waters, is known as "Kentucky Onyx" or "Mexican Onyx." It is found in caves in the cavernous limestone regions of the State, particularly in Edmonson,



KENTUCKY CAVE ONYX

Large quantities of such calcareous deposits are found in the caves of western central Kentucky, particularly in Edmonson and adjoining counties. This view is in the Great Onyx Cave.



KENTUCKY ASPHALT IN BARGES

The largest tonnages of rock asphalt now being produced in Kentucky are being barged down the Nolin and Green Rivers. This operation is located on Bear Creek, a tributary of the Green River.

Hart, Warren, Barren and Pulaski Counties. When sawed and polished it is used in interior decoration. Its development in Kentucky has been but slight, probably due to the fact that when left in a cave of even modest proportions it has great value for exhibition purposes. Caves that have been robbed of their deposits of stalactitic and stalagantic aragonite are shunned by tourists.

Asphalt (native rock):

These important Kentucky deposits, referenced above, are chiefly found in Edmonson, Grayson, Hart, Warren, Hardin, Breckinridge, and some adjoining counties in Western Kentucky. Deposits are also known to occur in Carter and Johnson Counties in Eastern Kentucky. The Western Kentucky deposits are for the most part of excellent quality. They exist in large quantities involving beyond any doubt several hundred million tons in the ground. Several large operations are now installed and working in this field, the prospects being bright for a very considerable expansion during the next several years. Eastern Kentucky deposits have not yet been commercialized for a number of reasons, the principal deterrent being heavy overburden in some of the better known localities.

KENTUCKY ASPHALT (NATIVE ROCK) PRODUCTION

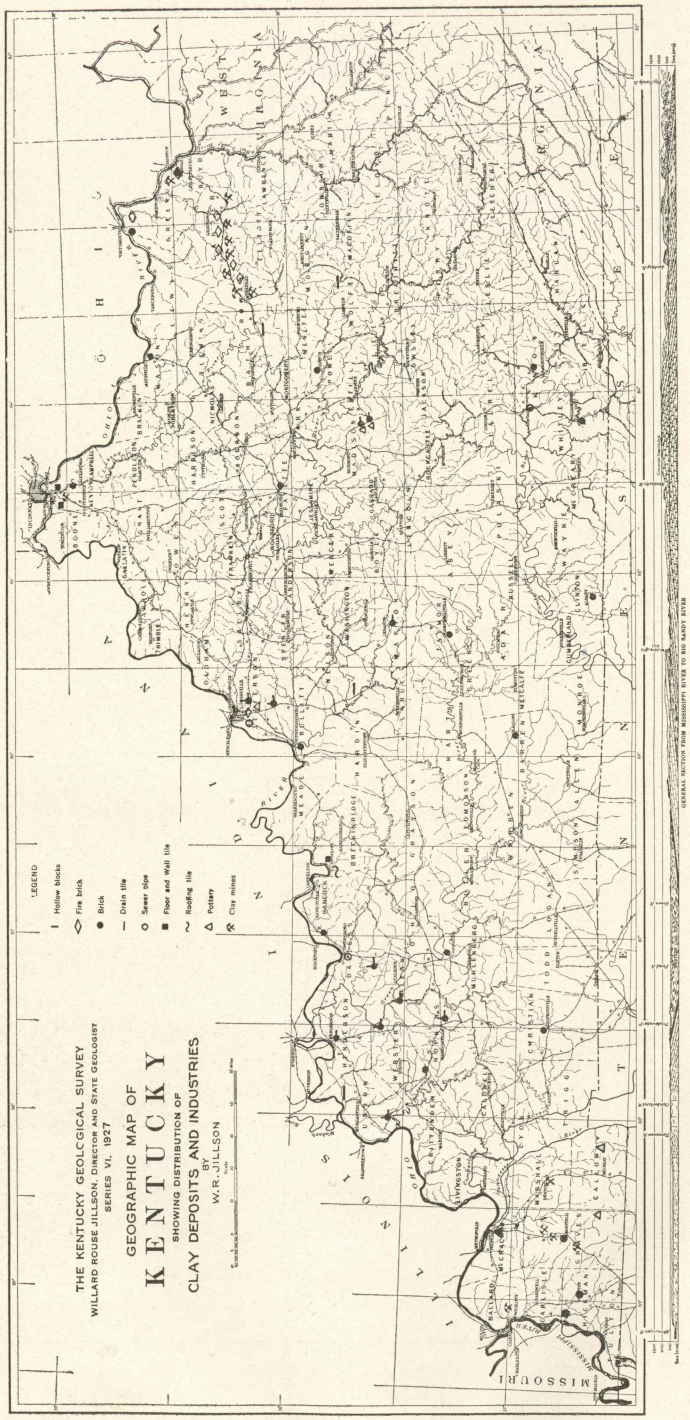
1923—139,401 Tons;	Value	$1,115,208.00
1924—245,929 Tons;	Value	1,967,932.00
1925—286,850 Tons;	Value	2,500,000.00

Barite:

Extensive veins of barite are known to occur throughout the central limestone or Bluegrass region of Northern Kentucky, particularly in Boyle, Mercer, Garrard, Fayette, Franklin, Owen and Henry Counties. Some small mines and open cuts have been extended from time to time in this field but none are now in actual operation. Deposits are such as to warrant much larger development when suitable marketing conditions exist. It is used chiefly in the paint industry and in the preparation of medicines.

Calcite:

This easily recognizable and broadly distributed mineral occurs in large and commercial quantities in Central Kentucky



PRODUCTIVE CLAY DEPOSITS OF KENTUCKY

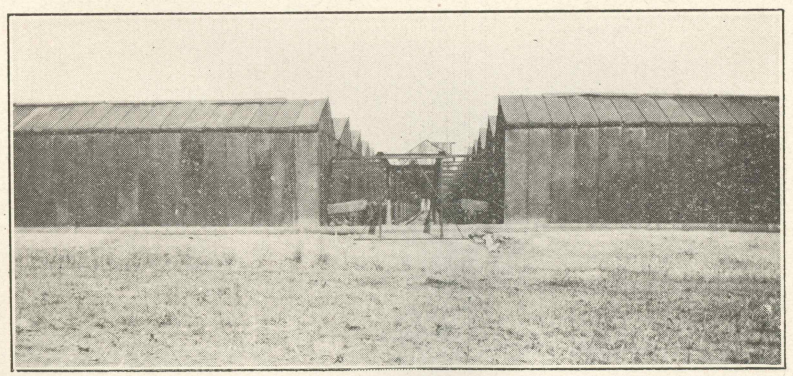
—the Bluegrass region—particularly in Mercer and Woodford Counties; but is also well known in Jessamine, Fayette, Clark, Bourbon, Franklin, Scott, Owen and Henry Counties. It is used in the manufacture of paint, putty, glass and other similar commodities. The deposits in central Kentucky are sufficient to allow of considerable development and profitable operation under favorable economic conditions.

Cannel Coal:

The largest deposits of cannel coal in the United States are found in Kentucky. This unique solid fuel, high in volatiles for gas making, and the delight of every lover of an open grate fire, is broadly distributed throughout the Eastern Kentucky coal field. It is also found at a number of localities in the Western Kentucky coal field. Beds of commercial importance occur in Morgan, Magoffin, Breathitt, Carter, Elliott, Floyd, Knox, Bell, Greenup, Hancock, Breckinridge and other Counties. The size of the cannel coal industry in Kentucky is relatively insignificant compared with the extent and quality of the deposits. Modern heating systems have practically outlawed its use for open grate consumption.

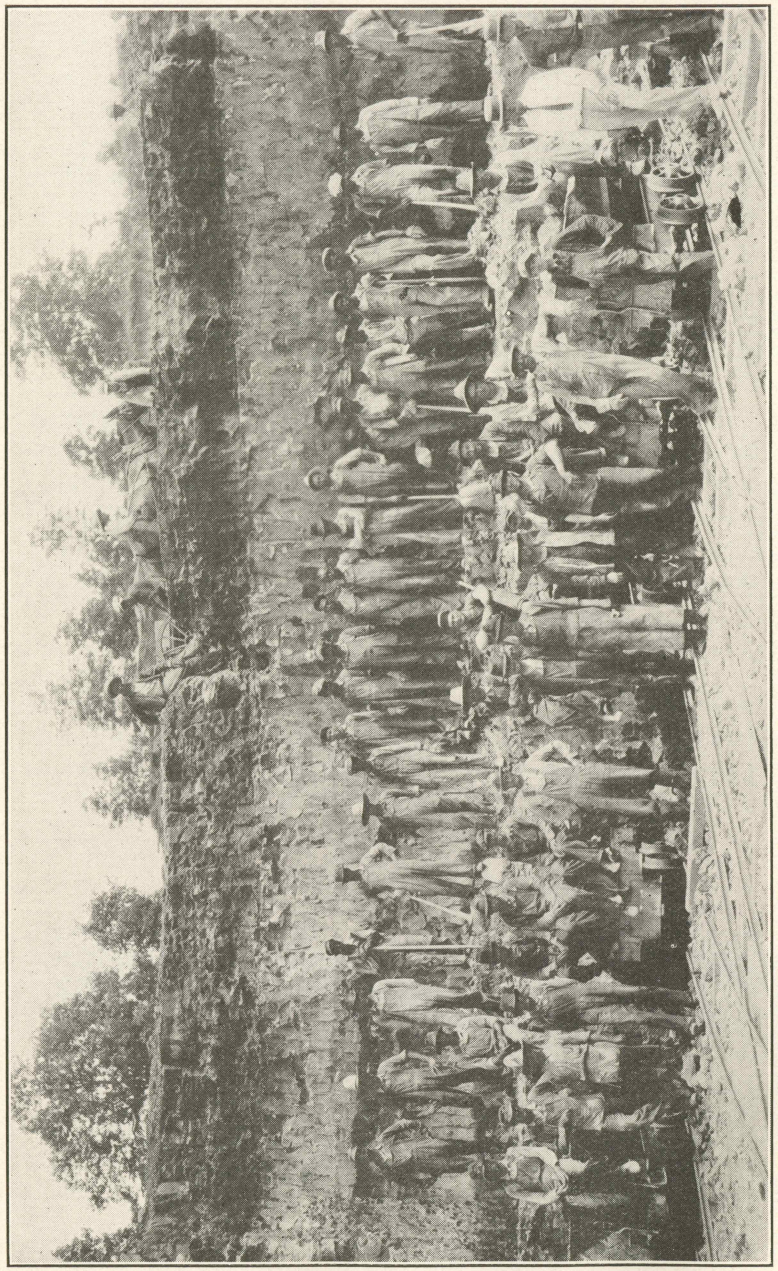
Carbon Black:

This important commodity is manufactured from natural gas in the field—that is at the point of production—and though not strictly speaking a mineral resource, it is usually classed in



A CARBON BLACK PLANT

This is the property of the Natural Gas Products Co. located near Campbellsville, in Taylor County, Ky. Low pressure gas of large volume produced locally is used here.

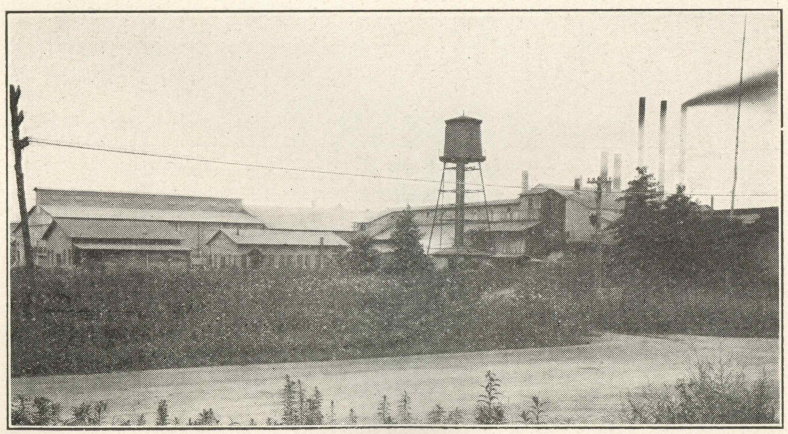


A WESTERN KENTUCKY CLAY PIT
This view shows a small section of the large open pit of the Kentucky Construction and Improvement Co., located near Mayfield in Graves County.

this group. In 1924 six separate plants were operating in Kentucky, in Floyd, Green, Taylor and Whitley Counties. The volume in 1925 was 7,309,378 pounds valued at $372,067.00, a decline of about 25% as compared to the preceding year. This decrease has been brought about by rapidly changing economic conditions favoring production of carbon black in the Southwest. Despite this fact suitable isolated natural gas fields far removed from public utilities pipe lines or existing towns occur or are indexed in Kentucky. In these areas under proper economic conditions a considerable expansion of this industry might be brought about, but it is doubtful if it will ever regain its former importance due to the growing demand for and diminishing supply of natural gas for domestic consumption.

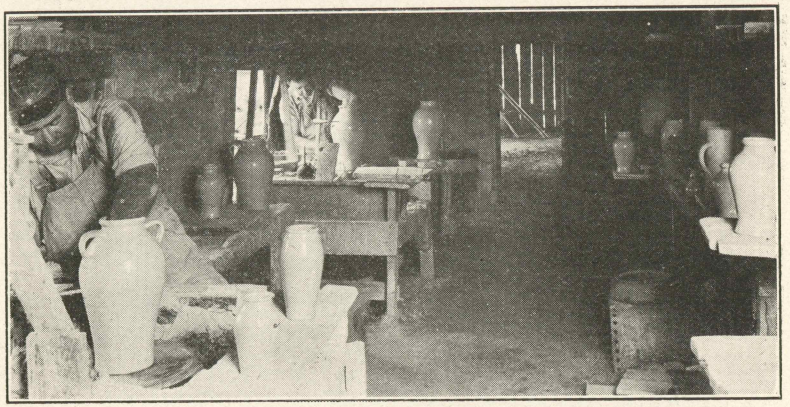
Cement:

Kentucky has but one Portland cement plant though cement making materials are broadly distributed throughout Eastern and Western Kentucky, particularly in the vicinity of the Ohio River. This State affords cement materials of excellent quality and suitable for a large expansion of this industry whenever favorable marketing conditions may be developed. The only plant now producing cement in this State is located in Jefferson County. In this operation Ohio Valley alluvial clays are com-



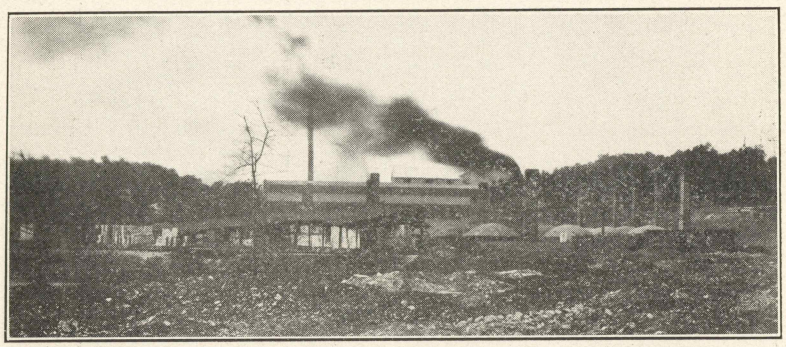
KENTUCKY CEMENT MILL
Although richly endowed with clays and limestones suitable for cement manufacture, this plant located at Kosmosdale in Jefferson County is the only one in the State.

bined in the dry process with rather pure limestones from Breckinridge County.



A KENTUCKY HAND POTTERY

This old pottery is located near Eybee in Madison County. Light Tertiary clays, probably a deposit of the Kentucky River are used. Other unworked deposits of similar age and character occur in Franklin County.



FLINT FIRE CLAY PLANT

Kentucky's Fire Clay deposits are first in quality and quantity. Located in northeastern Kentucky they comprise the largest single industry in this district. This view shows the ovens and storage of the General Refractory Co. at Olive Hill.

Clay and Clay Products:

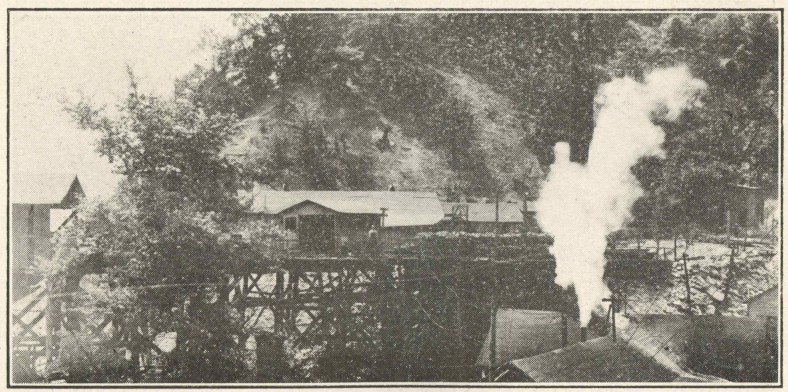
Situated in the heart of the Ohio Valley and in that part of the watershed which has been slightly glaciated, Kentucky is rich in clays and shales of all descriptions. These are suitable for brick, tile, pottery and Thermo-metallurgical purposes. Residual clays are found above stream level at almost any point necessary for dometsic use in this State. Transported clays

occur throughout the greater portions of all the major streams of the Commonwealth. This is particularly the case along the Ohio and Misssissippi Rivers.

Highly desirable Carboniferous fire clays occur in northeastern Kentucky in association with very high grade flint fire clays. Tertiary, ball and sagger clays are well distributed throughout the Jackson Purchase region, and pottery clays of Pliocene age suitable for the manufacture of art and domestic stoneware occur in Madison, Franklin, Anderson and other northcentral Kentucky counties closely boardering the Kentucky River. The clay and clay products industry of Kentucky in 1925 had a production valued at $7,973,977.00.

Coal:

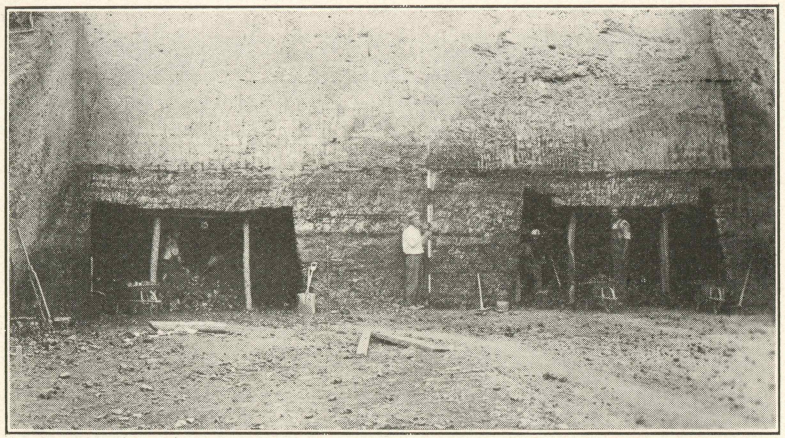
It is obviously impossible in a few words to do descriptive justice to the immense coal deposits of Kentucky. Suffice it to say that an industry of gigantic proportions has been built upon this single resource during the last decade. Though faced by the most severe competition it has continued to grow by leaps and bounds as the quality of the Kentucky product has become better known. In the Eastern coal field there are about ten seams which are of broad commercial importance, and many more which in the aggregate may be regarded as an ultimate reserve. In Western Kentucky four seams produce the bulk



BIG SANDY COAL OPERATION

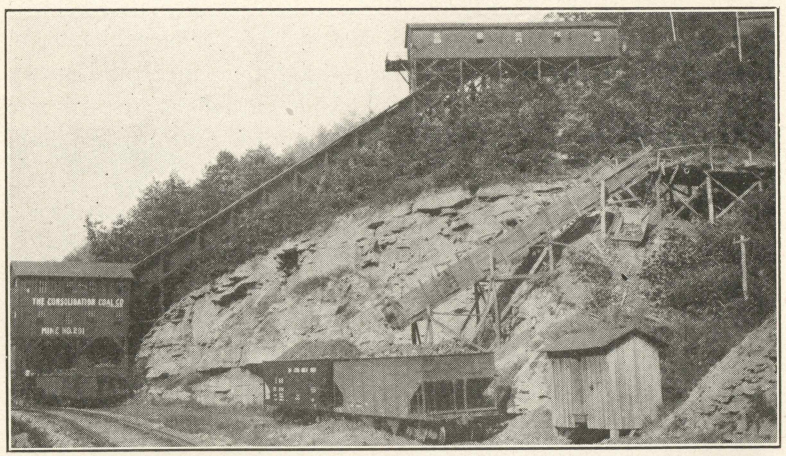
There is shown here the drift mouth of the main entry and a loaded train of mine cars proceeding to the tipple of the Middle Creek Coal Co. at Prestonsburg, Kentucky.

of the coal, though again there are many undeveloped and stray seams. In 1925 a full 650 operations were engaged in coal mining in Kentucky, producing an aggregate of 54,687,932 tons valued at $89,404,450.00. Kentucky's principal coal markets are located to the northwest in the highly industrial lake States.



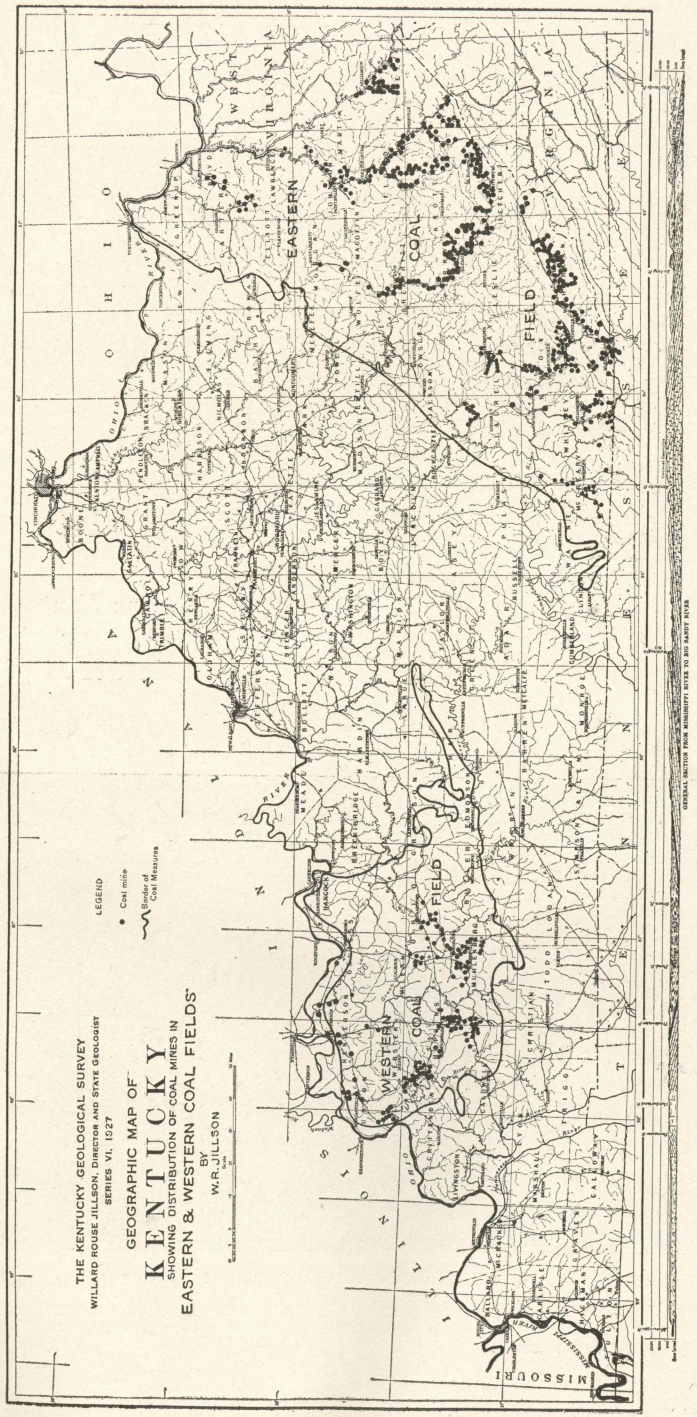
THE ELKHORN COAL

One of the original facings of this important commercial seam near Jenkins in Letcher County.



EASTERN KENTUCKY COAL MINE

This tipple is typical of the more important modern "drift" mines of Eastern Kentucky. Note the small "hand" mine in foreground.



DISTRIBUTION OF COAL MINES IN KENTUCKY

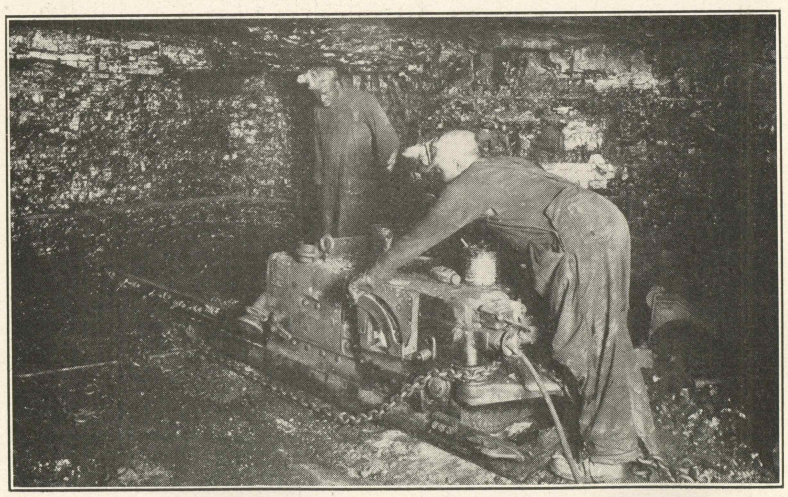
Only a very small per cent of the coal produced in Kentucky is consumed within the State.

KENTUCKY COAL PRODUCTION

1914—20,382,763	Tons;	Value	$20,852,463.00
1915—21,361,674	Tons;	Value	21,494,008.00
1916—25,393,997	Tons;	Value	30,193,047.00
1917—27,809,976	Tons;	Value	60,297,653.00
1918—31,530,442	Tons;	Value	94,591,326.00
1919—30,036,061	Tons;	Value	73,891,049.00
1920—38,892,044	Tons;	Value	159,457,380.00
1921—30,282,659	Tons;	Value	81,460,352.00
1922—42,134,175	Tons;	Value	127,037,000.00
1923—43,149,962	Tons;	Value	113,542,000.00
1924—43,387,732	Tons;	Value	88,745,968.00
1925—54,687,932	Tons;	Value	89,404,450.00

Coke:

Many of the coals in both Eastern and Western Kentucky are suitable for the manufacture of coke and artificial gas. By-product plants and beehive ovens were the producers of 559,711 tons of coke valued at $2,798,555.00 during 1924.

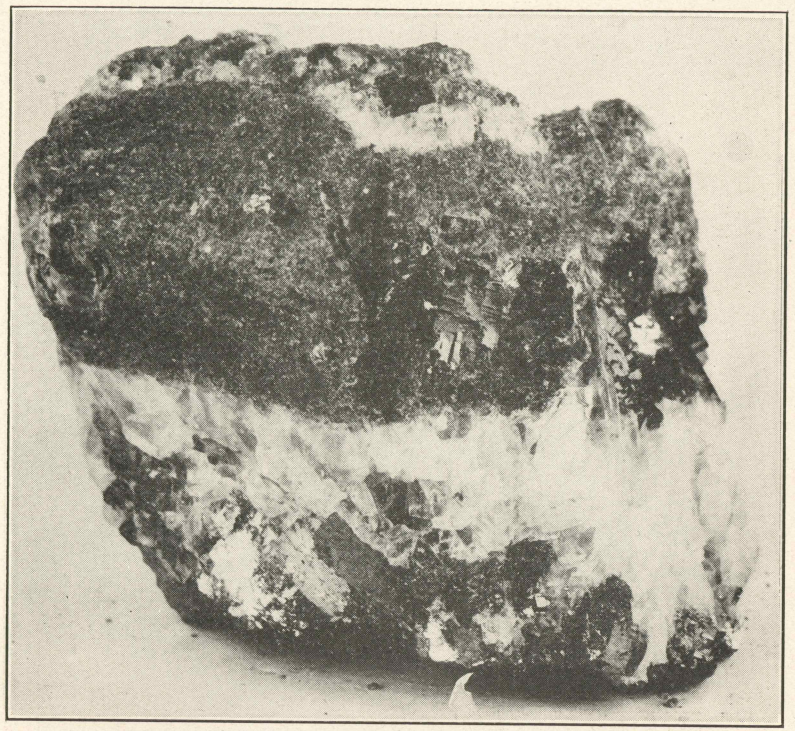


INTERIOR OF A COAL MINE

The view is at the working face of one of the largest coal mines of Western Kentucky. Following undercutting with this machine, the coal is shot down from above.

Fluorspar:

Kentucky is fortunate in possessing large deposits of this important industrial mineral. Fluorite, to use the mineralogical term, is now known to occur in commercial quantities in Cald-



FLUORITE AND GALENA

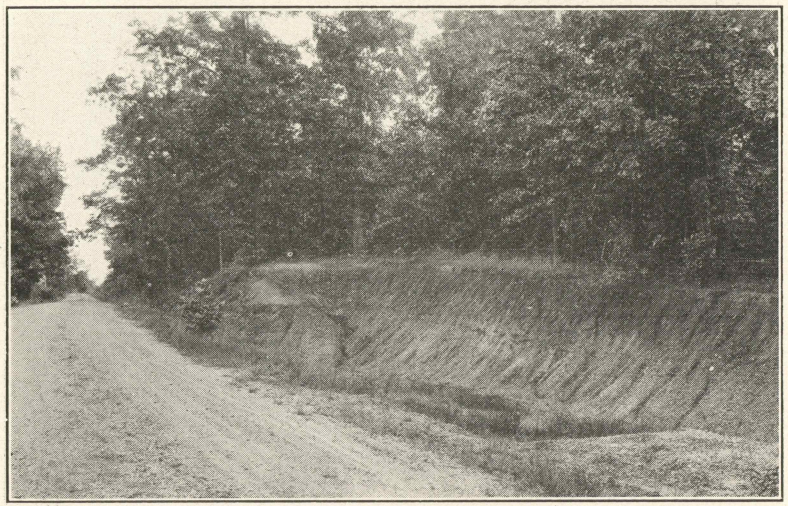
This fine hand specimen was taken from the mineral collection of the Kentucky Geological Survey. It was produced in Crittenden County.

well, Crittenden, Lyon and Livingston Counties in Western Kentucky; and in Mercer and Woodford Counties in Central Kentucky. A number of other counties in both Central and Western Kentucky exhibit smaller amounts. The mineral, glassy in appearance and variously colored from light straw to purple and green, is of fundamental importance to modern industry being used in the open hearth manufacture of steel, aluminum, glass enamel ware, and hydro fluoric acid. In 1926 as indicated above Kentucky produced 62,495 tons valued at $1,167,129.00. Under

suitable conditions of marketing demand created by expanding industry or restriction of importations, this production could be very considerably increased, and continuously maintained for a long period.

KENTUCKY FLUORSPAR PRODUCTION AND VALUE

1921—18,670	Tons;	Value	$360,146.00
1922—63,322	Tons;	Value	1,170,194.00
1923—56,803	Tons;	Value	1,181,509.00
1924—46,728	Tons;	Value	965,869.00
1925—44,826	Tons;	Value	833,794.00
1926—62,495	Tons;	Value	1,167,129.00



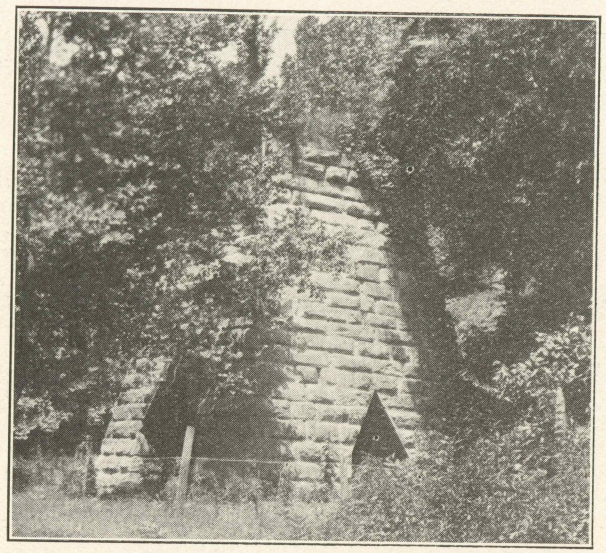
GRAVEL PIT AND ROAD

Immense deposits of excellent gravel suitable for road and general building construction occur in many parts of this State although Kentucky was but slightly glaciated. This pit shows three-quarter inch clean gravel and is located in Southern Graves County.

Gravel:

Although but very slightly glaciated along its northern border, Kentucky contains large deposits of gravel of all necessary grades, principally as stream deposits. The Ohio River is the largest and most extended source of supply. Considerable deposits of residual gravel occur west of the Cumberland River in Western Kentucky, and in Eastern Kentucky along the edge of the coal field. In 1924 gravel deposits of this State produced

2,641,415 tons valued at $1,039,417.00. In the year 1925 due to severe reductions in the use of gravel for ballast on railroads, and the substitution of other paving materials only 1,495,537 tons of gravel valued at $960,120.00 were produced.



AN OLD IRON FURNACE

Kentucky's large deposits of low grade iron ores are not worked at the present time. The extent of the former iron industry in Kentucky is attested by such relics as this—the Mount Savage furnace in Carter County.

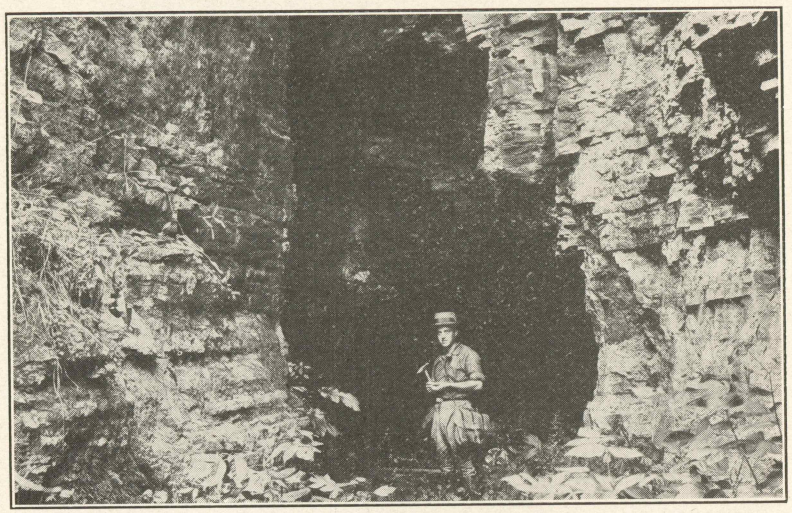
Iron:

Large deposits of low grade iron ore are broadly distributed throughout Kentucky. In the Eastern part of the State carbonates are the most important, but hematite is also known to occur. In Western Kentucky, particularly in the vicinity of Trigg and Lyon Counties on the Cumberland and Tennessee Rivers, there are large deposits of limonite. At some future time when the presently operated high grade deposits of iron ore in the Mesabi and Birmingham districts become exhausted, Kentucky iron ores will probably again become of commercial significance.

Lead:

Throughout the limestone regions of Kentucky, and particularly in the central part of the Bluegrass, and in the Western

part of the State near Marion, ores of lead occur generally as the sulphide, galena. These ores are for the most part widely disseminated and can be operated successfully only as a by-product. They occur most usually with other vein or fissure



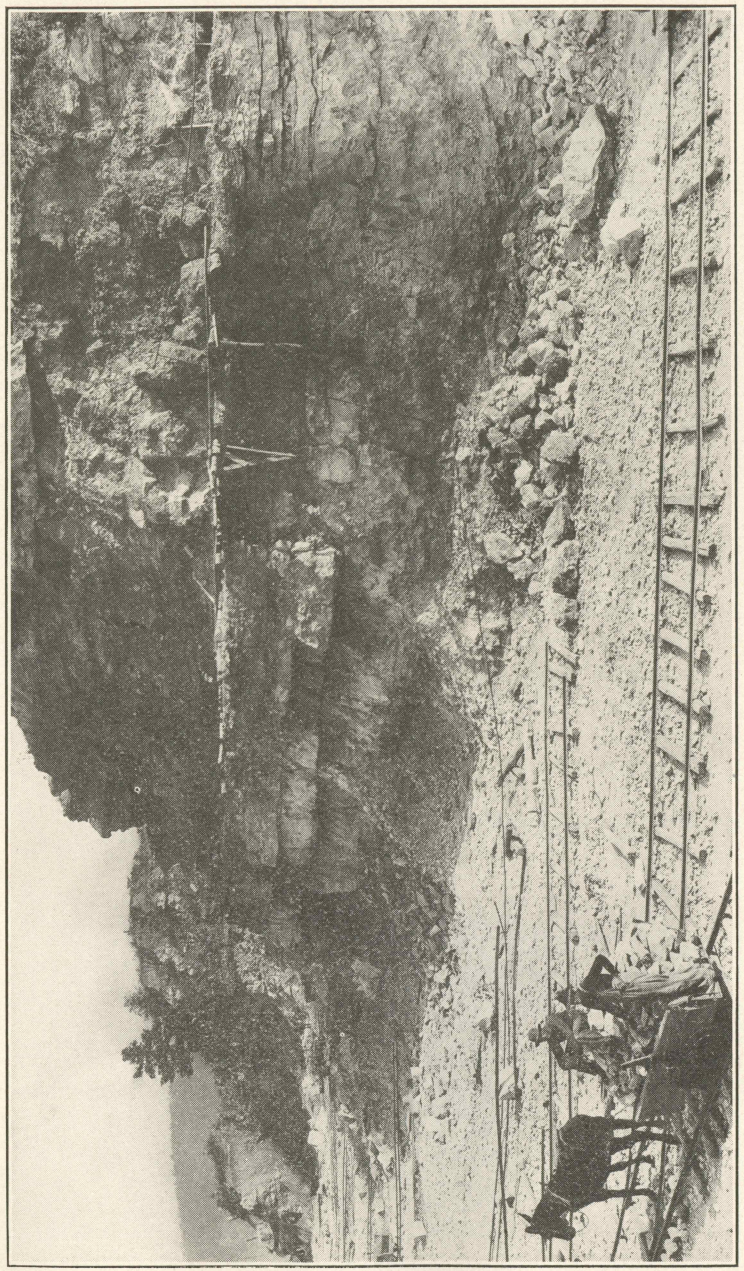
KENTUCKY RIVER LEAD MINE

A number of years ago a fissure deposit of galena and barite was worked near Gratz in Owen County. Operation had been discontinued for some time when the author took this photo of a drift entry into the vein above the Kentucky River. Considerable amounts of lead were produced here.

deposits of calcite, barite and fluorspar, though some amounts of galena associated with Sphalerite or mineral free, in limestone, are known.

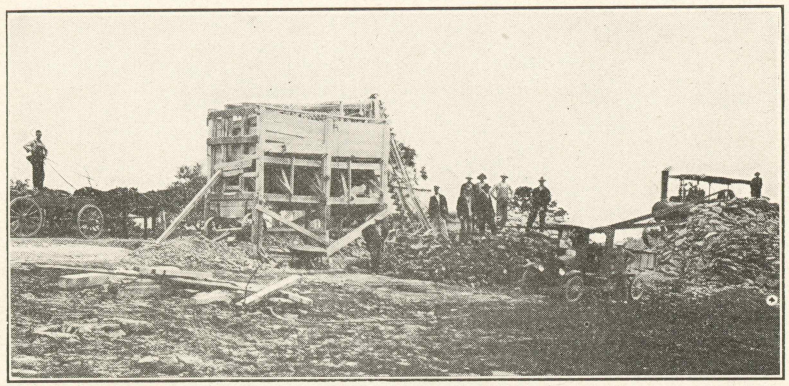
Lime:

Kentucky is well known for its limestone. These deposits constitute the greater portion of the northern Bluegrass and the Pennyroyal plateaux exhibiting several beds which are of excellent quality and unlimited quantity. These limestones are suitable for all purposes, ranging from agricultural to chemical lime. Chief among the individual beds of significance are the St. Genevieve and Gasper of the Pennyroyal, and the Tyrone of the Bluegrass region.



LIMESTONE QUARRY IN EASTERN KENTUCKY

Considerable deposits of limestone are found everywhere in this State except in the coal fields and west of the Tennessee River. This quarry in the St. Genevieve and St. Louis limestones is operated by the Tygart Limestone Co. at Lawton, Carter County.



PRODUCING ROAD MATERIAL

One of the very important mineral resources of Kentucky is inexhaustible deposits of limestone, suitable for road construction purposes. This crushher is located in Franklin County near Frankfort.

Lithographic Stone:

Stone suitable for lithographic purposes occurs in Rowan, Estill, Jefferson and Meade Counties. At the present time there is no utilization of this rock, due to more advantageous conditions surrounding production elsewhere in America and abroad.

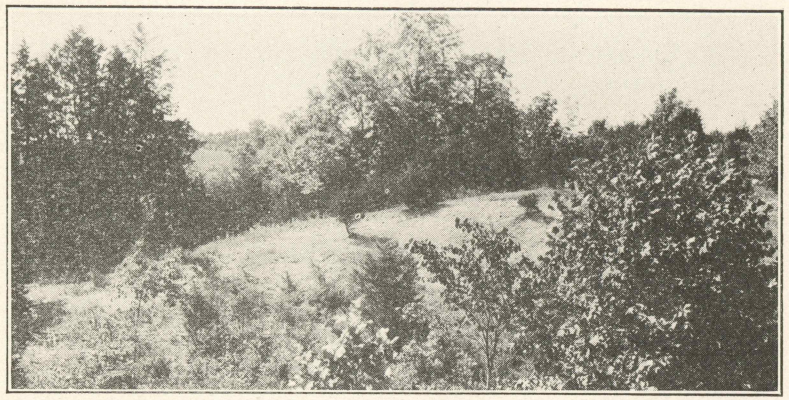
Marble:

Bedded limestones characteristically crystalline by replacement are broadly distributed throughout central and western Kentucky. These limestones are susceptible of excellent finish in the way of a polish, and are therefore classed among the commercial marbles. Up to the present time none of these marbles have been used for building construction or decorative purposes, except to a very slight extent. A very limited use has been made of some of these marbles for monumental purposes.

Marl:

Shales and clays sufficiently high in granular silica and calcium carbonate to be designated as marls are found in a number of areas throughout Kentucky. Although their occurrence has been known for some time, it is only within recent years that they have been made to serve the important purpose of mineral fertilizer for worn or leached agricultural lands. The domestic marl industry of Kentucky might reasonably be increased many

times its present size. Volume of production now amounts to many thousands of tons annually and is rapidly growing.

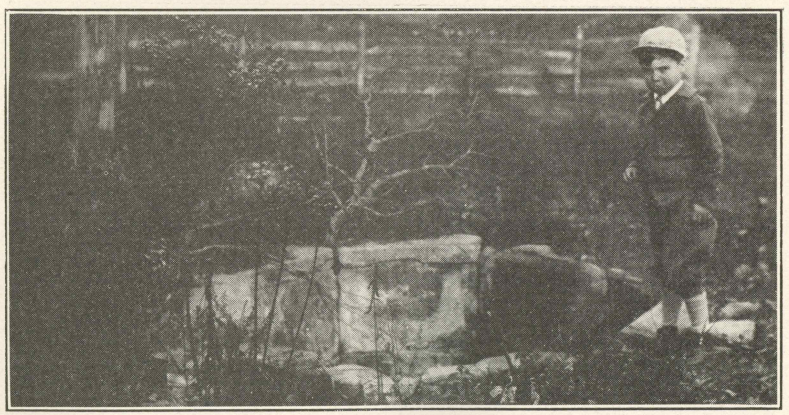


MARL DEPOSITS IN CENTRAL KENTUCKY

In a number of districts of the "outer Bluegrass" region beds of marl such as this one on the form of C. M. Bringle in Washington County are available for agricultural purposes.

Mineral Waters:

During the latter part of the last century Kentucky was well and favorably known throughout the United States for the quality of its mineral waters. Such springs as those occurring at Olymphia, Blue Licks, Crab Orchard, Big Boone, Dawson and



OLD SPRING AT BLUE LICKS

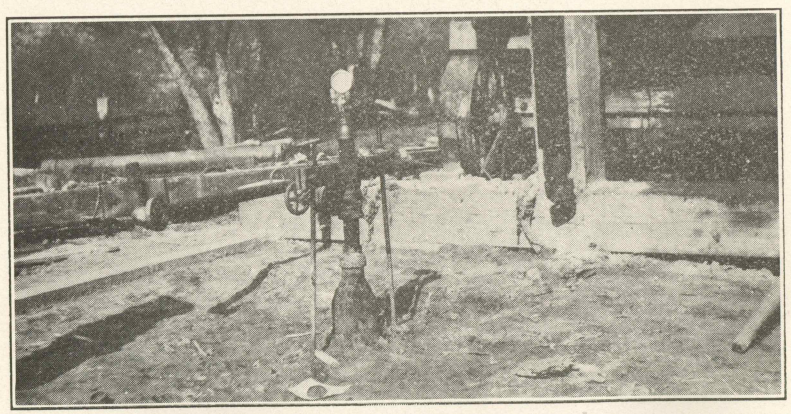
This mineral spring located in the Licking River valley in Nicholas County near the Fleming County line is one of the oldest and most celebrated in Kentucky. Willard R. Jillson, Jr., at right.

elsewhere bore an honorable and justly deserved reputation. The waters of many of these springs compare most favorably with some of the most celebrated spas in Europe at the present time.

Within recent years, however, the mineral waters of this State have been receiving much less attention from a commercial standpoint than they deserve. This is undoubtedly due to the fact the American people have definitely abandoned the custom of vacationing as Europeans still do, at "the Springs." While Kentucky has no hot springs it has cold saline, salt, sulphur, chalybeate, litha, and epsom springs of pronounced value.

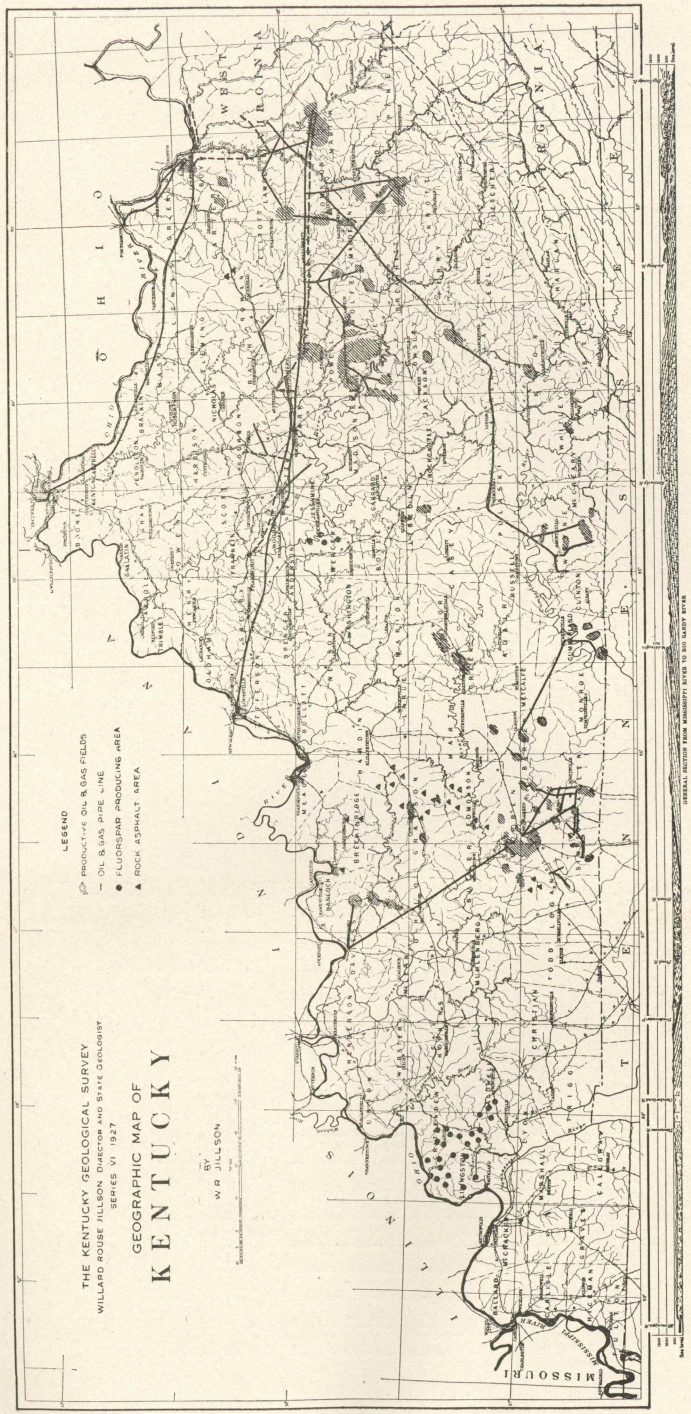
Natural Gas:

This convenient fuel, important both to industry and to domestic consumers, is widely distributed in Kentucky, gas fields of large commercial importance being found throughout the Eastern Kentucky coal field, Southern Kentucky and Western Kentucky east of the Cumberland River. In 1926 it is estimated 15,800,000 M. cubic feet of natural gas were produced in Kentucky valued at $4,740,000. The natural gas industry in this State is steadily expanding and apparently has an excellent future immediately ahead of it. The total production of natural gas in Kentucky, however, is small compared to that of the United States which in 1925 produced 1,188,571,000 M. of cubic



A NATURAL GAS WELL

This well is completely "closed in" and connected with line ready to produce. It is located in a very considerable undeveloped gas territory in Clay County.



PRODUCTIVE OIL, GAS, ASPHALT AND FLUORSPAR FIELDS OF KENTUCKY

feet of natural gas. During recent years Kentucky's production of natural gas has ranged about 1% of that of the entire country.

M CUBIC FEET NATURAL GAS PRODUCED IN KENTUCKY

Years 1914-1926

Year	Volume	
1914	1,421,818 M	
1915	1,667,423 M	
1916	2,106,542 M	
1917	2,802,079 M	
1918	3,022,439 M	
1919	2,057,000 M	
1920	3,345,000 M	
1921	4,820,000 M	
1922	5,872,000 M	
1923	11,953,000 M	Estimated
1924	12,875,000 M	
1925	14,275,000 M	
1926	15,800,000 M	

VALUE OF NATURAL GAS PRODUCED IN KENTUCKY

Years 1905-1925

Year	Value
1905	$237,290.00
1906	287,501.00
1907	380,176.00
1908	424,271.00
1909	485,192.00
1910	456,293.00
1911	407,689.00
1912	522,455.00
1913	509,846.00
1914	490,875,00
1915	614,998.00
1916	752,635.00
1917	580,380.00
1918	665,843.00
1919	695,000.00
1920	1,064,000.00
1921	1,597,000.00
1922	1,879,000.00
1923	3,156,000.00
1924	3,432,000.00
1925	4,282,000.00

Natural Gas Gasoline:

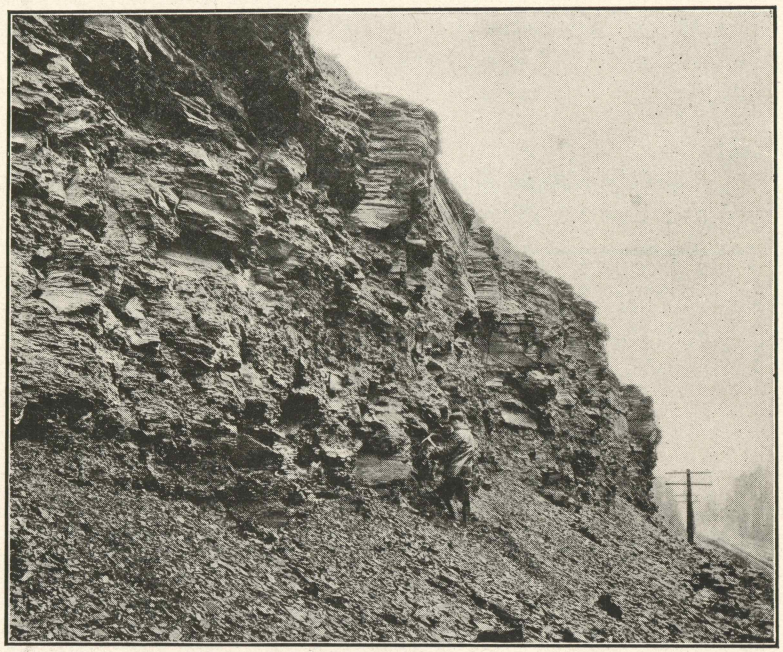
Straight run gasoline is taken by compression or by absorption from natural gas. It is produced in a number of counties in Kentucky, particularly those where natural gas occurs or natural gas pipe lines are found. In 1925, Kentucky's production of natural gas gasoline showed 7,685,000 gallons valued at $884,000.00. The industry has been gradually increasing during the last decade and indications are that this upward trend will continue.

Ochre:

Variously colored clays, in many respects similar to those used as a base for mineral paints, are known to occur in Ken-

DEVONIAN OIL SHALE OUTCROP IN KENTUCKY

tucky. Generally, however, these distinctive deposits are impregnated with such amounts of granular silica as to make them of secondary importance to industry at the present time. There are no operations devoted to the development of Ochre in Kentucky.



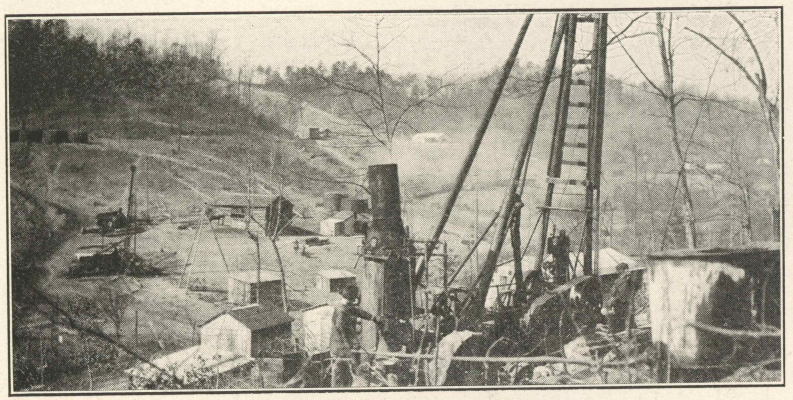
TYPICAL OIL SHALE EXPOSURE

The outcrop of the Devonian Oil Shale is crescentic in Kentucky. With the Ohio River on the north it surrounds the Blue Grass Region.

Oil Shales:

The largest deposits of oil shales in the Eastern United States suitable immediately for commercial operation are those of the Chattanooga black shale found along the Devonian outcrop in central and southern Kentucky. Thicknesses varying from 30 feet to about 125 feet may be measured on outcrop, and this formation thickens as one proceeds to the East or the West, away from the Cincinnati Arch. The oil content secured by destructive distillation varies from about 8 to 27 gallons of oil to the ton of shale. Upwards of 5,000 or 10,000 cubic feet of gas are produced at same time. One plant is now in the stages

of experimental operation at Mt. Sterling, in Montgomery County, Kentucky. It has been estimated that there are 12,308,-217,000 barrels of Devonian shale oil available in the ground for commercial operation in Kentucky. Besides these central Kentucky deposits, the Carboniferous rocks of both Eastern and Western Kentucky contain many bituminous cannel shales, including the Sunbury shales (Mississippian) which are of secondary importance.



OIL FIELDS OF EASTERN KENTUCKY

This view shows drilling operations on one of the creeks of Estill County. The field is shallow and oil is found in the "Corniferous" limestone Devonian.

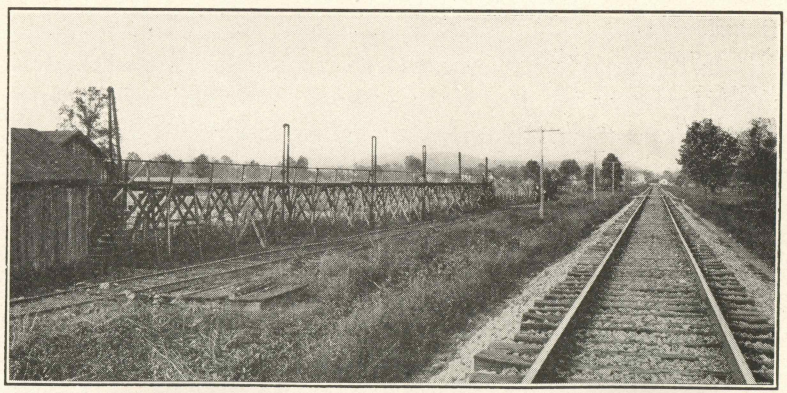
Petroleum:

In Kentucky, petroleum secured from drilled wells has been in use for over a hundred years. The first productive wells were drilled in Southern Kentucky on the South Fork of the Cumberland River in 1819. The drillers sought to secure brines from which to produce salt. They drilled into oil by mistake and regarding it of no value abandoned the undertaking.

The commercial development of petroleum in Kentucky dates from about 1880. While this State has witnessed several waves of exploration for both oil and gas, it it is only during the last score of years that large amounts of either have been produced. At the present time there are forty-four commercially important oil and gas pools producing in Kentucky.

The productive oil and gas fields of Kentucky are as follows:

1. Mead County, Old Gas Field.
2. Cloverport, Old Gas Field.
3. Hartford Oil Pool.
4. Caneyville Oil Pool.
5. Leitchfield Oil and Gas Field.
6. Bear Creek Gas Field.
7. Diamond Springs Gas Field.
8. Warren County Oil and Gas Fields.
9. Allen County Oil and Gas Fields.
10. Barren County Oil and Gas Fields.
11. Greensburg Gas Field.
12. Lincoln County Oil Pools.
13. Wayne County Oil Pools.
14. Knox County Oil and Gas Field.
15. Clay County Gas Field.
16. Island Creek Gas Field.
17. Station Camp Oil Pool.
18. Irvine Oil Pool.
19. Big Sinking Oil Pool.
20. Ross Creek Oil Pool.
21. Menifee County Gas Field.
22. Menifee County Oil Pool.
23. Ragland Oil Pool.
24. Campton Oil Pool.
25. Still Water Oil Pool.
26. Breathitt County Gas Field.
27. Cannel City Oil and Gas Pool.
28. Knott County Oil Pool.
29. Beaver Creek Oil and Gas Field.
30. Prestonsburg Oil and Gas Field.
31. Burning Fork Gas Field.
32. Paint Creek Oil and Gas Field.
33. Laurel Creek Oil and Gas Field.
34. Martin County Gas Field.
35. Bussyville Oil Pool.
36. Fallsburg Oil Pool.
37. Williamsburg Gas Field.
38. Cumberland County Oil Pools.
39. Ashland Gas Field.
40. Licking River Gas Field.
41. Ida May Oil Pool.
42. Booneville Gas Field.
43. Pellville Oil Pool.
44. Ohio County Oil Pools.



OIL LOADING RACK

This is the terminus of the pipe line leading from the old Ragland Oil Pool in Southern Bath County, Kentucky to Salt Lick on the Chesapeake and Ohio Railway.

KENTUCKY OIL PRODUCTION

1918—4,308,893 Bbls.;	Value	$11,128,421.00
1919—9,226,473 Bbls.;	Value	24,459,017.00
1920—8,552,877 Bbls.;	Value	33,556,241.00
1921—9,080,845 Bbls.;	Value	16,674,969.00
1922—8,889,303 Bbls.;	Value	17,532,766.00
1923—8,087,250 Bbls.;	Value	15,189,916.00
1924—7,437,232 Bbls.;	Value	14,418,982.00
1925—6,658,803 Bbls.;	Value	15,290,167.00

During the year 1925, the production of the State was 6,658,803 barrels valued at $15,290,167.00. The total production in Kentucky up to the beginning of 1927 amounts to about 80,000,000 barrels.

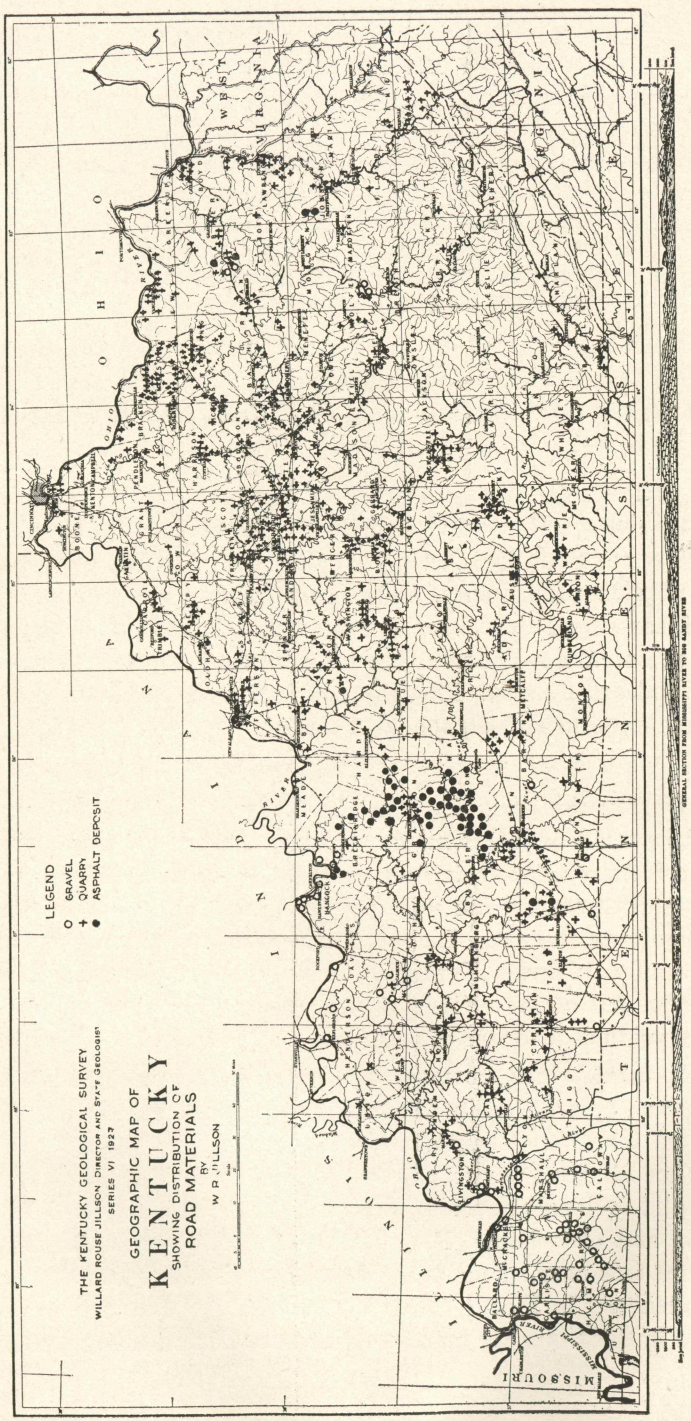
Phosphate Rock:

In central Kentucky, principally in Woodford, Franklin and Fayette Counties, there occur deposits of brown phosphate in Ordovician limestones. These phosphates are of commercial significance and have been operated to a considerable extent. The principal development has been in the vicinity of Wallace in Woodford County. Phosphate is used as a fertilizer and in the manufacture of phosphoric acid.

Salt:

During the early days in Kentucky, all of the salt used by the settlers of this Commonwealth was produced from brines taken from natural springs or wells dug near natural "Licks." Outstanding among the salt springs of this period were those at Big Bone and Blue Licks. There were others in the Salt, Big Sandy, Licking, Kentucky, and upper Cumberland River valleys. All of these "Licks" have now been abandoned for many years as a source of salt.

Natural brines, however, are today being produced in oil and gas exploration in Kentucky, but such brines are not utilized for salt. Their abandonment is due to the fact that they are relatively weak as compared to the brines taken from the solid rock salt deposits of New York, Michigan, Louisiana, Texas and elsewhere. For many years, however, salt manufacture was carried on near Manchester in Clay County and Brandenberg in Meade County. Though the best brines produced in this State are, what might be considered under present



DISTRIBUTION OF ROAD MATERIALS IN KENTUCKY

competitive conditions, low grade, many of them are probably sufficiently rich to be used without much evaporation in connection with some chemical manufacturing purposes. A profitable utilization of such brines would require plant location to be quite as advantageously situated in or near the producing fields as elsewhere. An interesting unsolved problem of chemical and industrial research is presented by this particular mineral resource situation.

Sand:

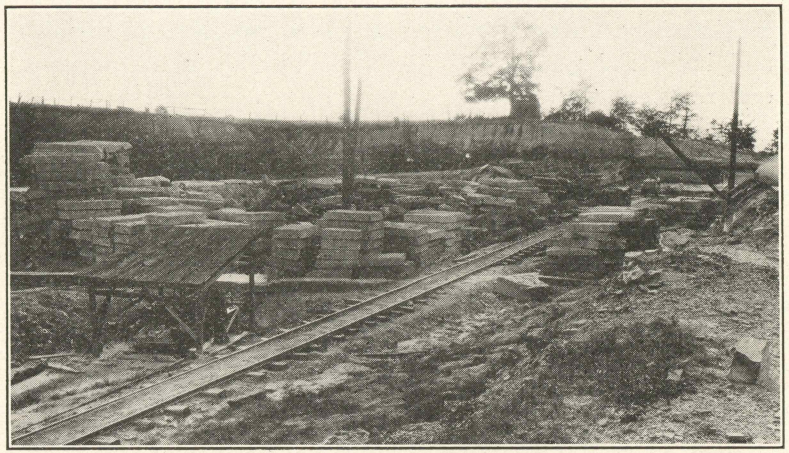
Practically unlimited amounts of loose sand and friable sandstone easily pulverized into sand are available in Kentucky for all general purposes such as glass sand, molding sand, coring sands, and the like. The State's largest deposits of sand are found in the proximity of the Ohio River from the bed of which construction sands to fit any specification can be and are dredged annually in very large quantities. Bordering the Ohio some of the best molding and coring sands in the Eastern United States are found and operated. At various points in this State, particularly Carter County in Eastern Kentucky, and Grayson and Crittenden Counties in Western Kentucky, large deposits of friable sands suitable for glass manufacture are located advantageously with respect to a considerable supply of developed and undeveloped natural gas, the ideal fuel. Large commercial sand deposits occur in Trimble, Jefferson, Bullitt and Hardin Counties. Sand production in 1924 attained a volume of 783,132 tons valued at $565,652.00. In the succeeding year 1925, this State produced 907,445 tons of sand valued at $810,338.00 indicating a present very rapid growth in this important and inexhaustible mineral resource.

Stone:

Both limestone and sandstone in easily worked and unlimited amounts are widely distributed throughout Kentucky. The sandstone and limestone formations of the State have such variable range as to provide practically the fulfillment of any reasonable specification for building, abutment, bridge, railroad or highway construction that may be given. Among the best building stones of the State are the Bowling Green and

Princeton oolites and the Rowan and Rockcastle County free stones.

Kentucky produces one grade of limestone suitable particularly for designation in building construction, retaining



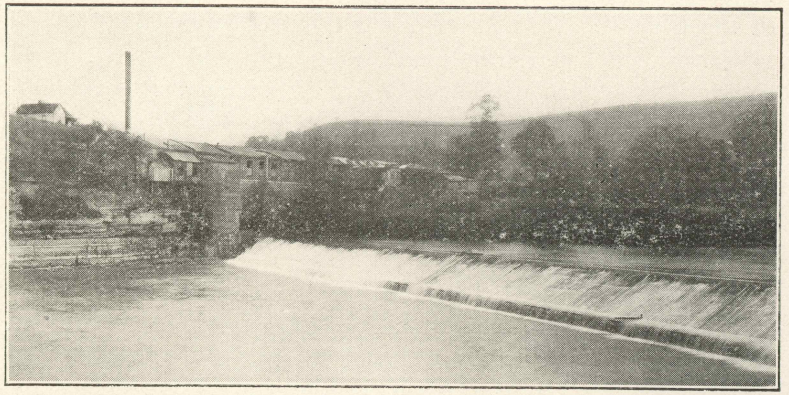
BLUE STONE QUARRY NEAR MOREHEAD, KENTUCKY
Large amounts of fine grain sandstone suitable for the best types of building construction are available in Rowan and Rockcastle Counties from beds in the Lower Mississippian System—Waverly.

walls, fences and approaches. This is the Tyrone limestone. It is found outcropping along the Kentucky River from Boonesboro down stream to the vicinity of Frankfort. This rock which was used in the construction of the Old Capitol building in 1828 is notable for the fact that in weathering it becomes chalky white. Being very compact it retains this appearance even in the presence of much smoke and soot, thereby developing a favorable contrast with most other limestone used for building construction. The building and general stone industry in Kentucky is one which is but slightly developed, compared to its possibilities. In 1925, eighty-one plants and quarries produced 1,703,010 tons valued at $2,127,-504.00.

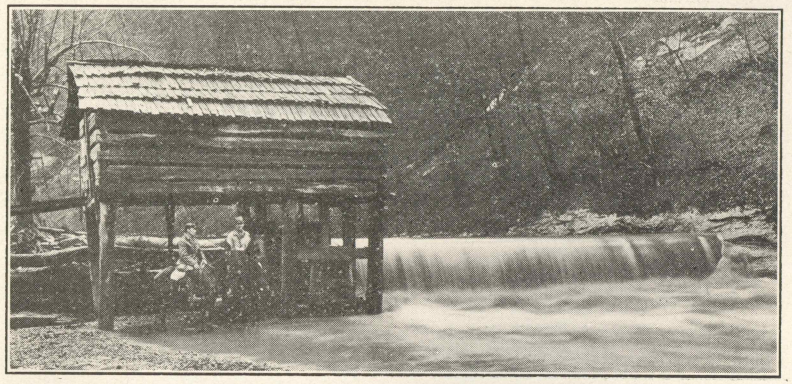
Water Resources:

Water power development in Kentucky has grown tremendously during the last decade, but the sum total of hydro-electric plants now installed produces only a small fraction of the potential water power of the Commonwealth. A large

hydro-electric unit is now being installed at the Falls of the Ohio at Louisville, and other projects of considerable size have



WATER POWER ON KENTUCKY RIVER
Plans are being made to make use of power now wasting on practically all of the fourteen locks of the Kentucky River. This view shows a hemp mill on Lock No. 4 at Frankfort, Kentucky.



A MOUNTAIN WATER POWER MILL
Many grist mills similar to this one owned by Turner and Bowling on Longs Creek in Breathitt County are to be found throughout Eastern Kentucky. The aggregate water power thus utilized is considerable.

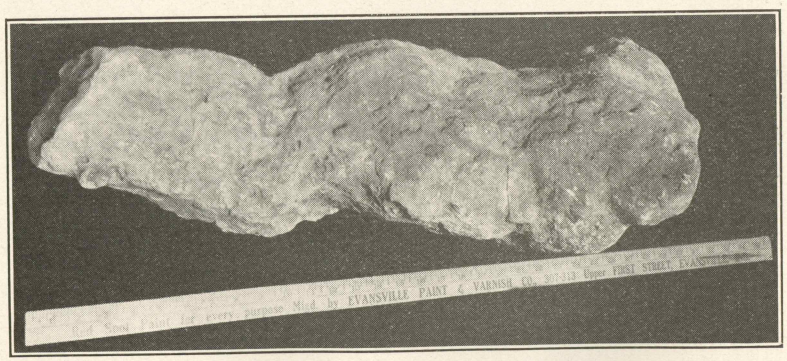
been proposed for the Cumberland, Kentucky, Licking and Green Rivers. The largest operating plant in Kentucky is that located on the Dicks River three miles above its junction with the Kentucky River. At this point the Kentucky Hydro-Electric Co. has a maximum daily capacity of 436,000 kilowatt hours. This installation averages about 100 million kilowatt hours annually due to fluctuating water supply.

Transportation by water is one of the real and indestructible assets of this Commonwealth. The State has 605 miles of navigable streams served by Federal locks and dams, exclusive of the Ohio River which is now navigable from Catlettsburg to Cairo a total of 650 miles. This is equivalent to the entire northern boundary of Kentucky. The principal minor tributaries of the Ohio are suitable for navigation. These are the Tennessee, Cumberland, Salt, Kentucky, Licking and Big Sandy Rivers.

The new hydro-electric unit being built at the falls of the Ohio by the Louisville Gas and Electric Company will produce about 135,000 horsepower. The entire installation is now estimated to cost a total of $10,500,000. Slack water will extend up stream above the dam to the vicinity of Madison, Indiana. The new Louisville electric unit will be tied in with the presently operating steam plant of this company now producing a daily capacity of 125,000 horsepower.

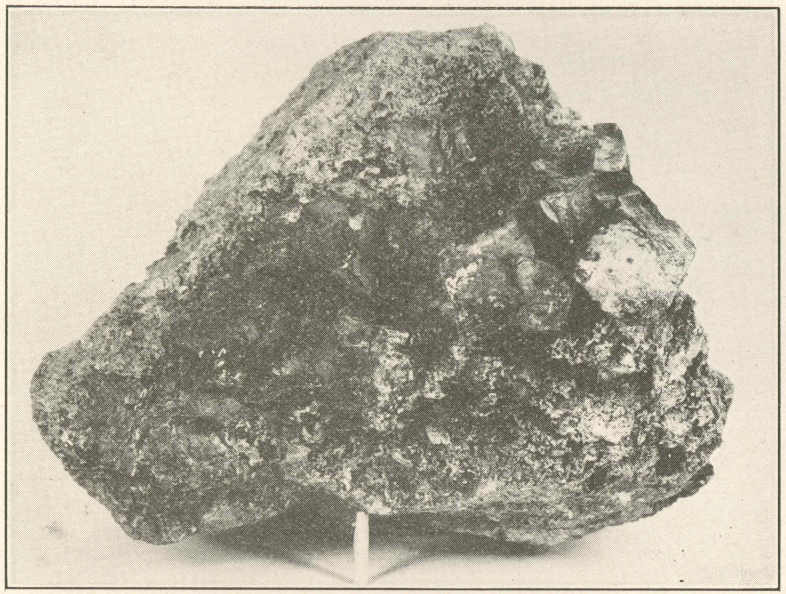
Zinc:

Ores produced in connection with fluorspar, barite, calcite and lead mining in Kentucky give a small amount of zinc, particularly sphalerite from which zinc is recovered in small quantities as a by-product. Commercial deposits of zinc ores suitable for operation separately from other metals or non-metallic minerals are not known in Kentucky. The principal producing area is the Western Kentucky Fluorspar Field in which during 1924 there were produced 492 tons valued at $63,960.00. Zinc ores are alsco known to occur in small quantities at many points throughout central Kentucky.



ZINC CARBONATE, MARION, KENTUCKY

In addition to the minerals described above which are found in commercial quantity, the following are known to occur in this State though in quantity or quality of non-commercial grade: Copper ores, Gypsum, Kaolin, Manganese ore,



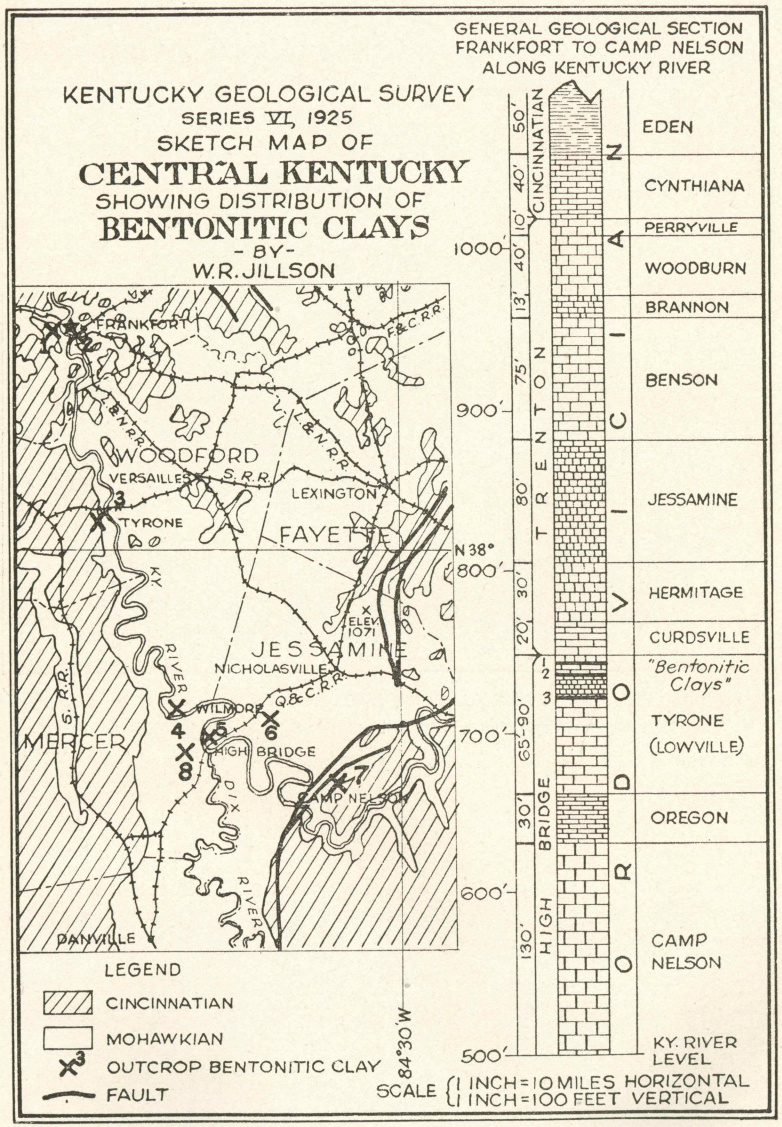
GALENA AND SMITHSONITE

This specimen taken from the mineral cabinet of the Kentucky Geological Survey was secured near Marion in Crittenden County, Kentucky. Both lead and zinc ores occur in this part of Kentucky.

Mica, Silver ores, Potash salts, Pyrites, Bentonite and others. The existence of these minerals and ores, however, is of much scientific importance, and it is possible that further mining and geological investgatons may yet reveal some of them in superior condition.

The post war prices of all crude minerals have become greatly reduced. Taken in the aggregate, therefore, the value of Kentucky's mineral resources at the present time is not as great as during the period immediately preceding 1920. This somewhat anomalous condition exists although the total volume of minerals annually produced now is much greater than at any time previously. In 1924, Kentucky's mineral resources were valued at $134,430,774.00 Preliminary estimates for 1925

indicate $142,434,555.00, and the year 1926 will probably witness a value in excess of $150,000,000.00.



GEOLOGY OF KENTUCKY BENTONITES

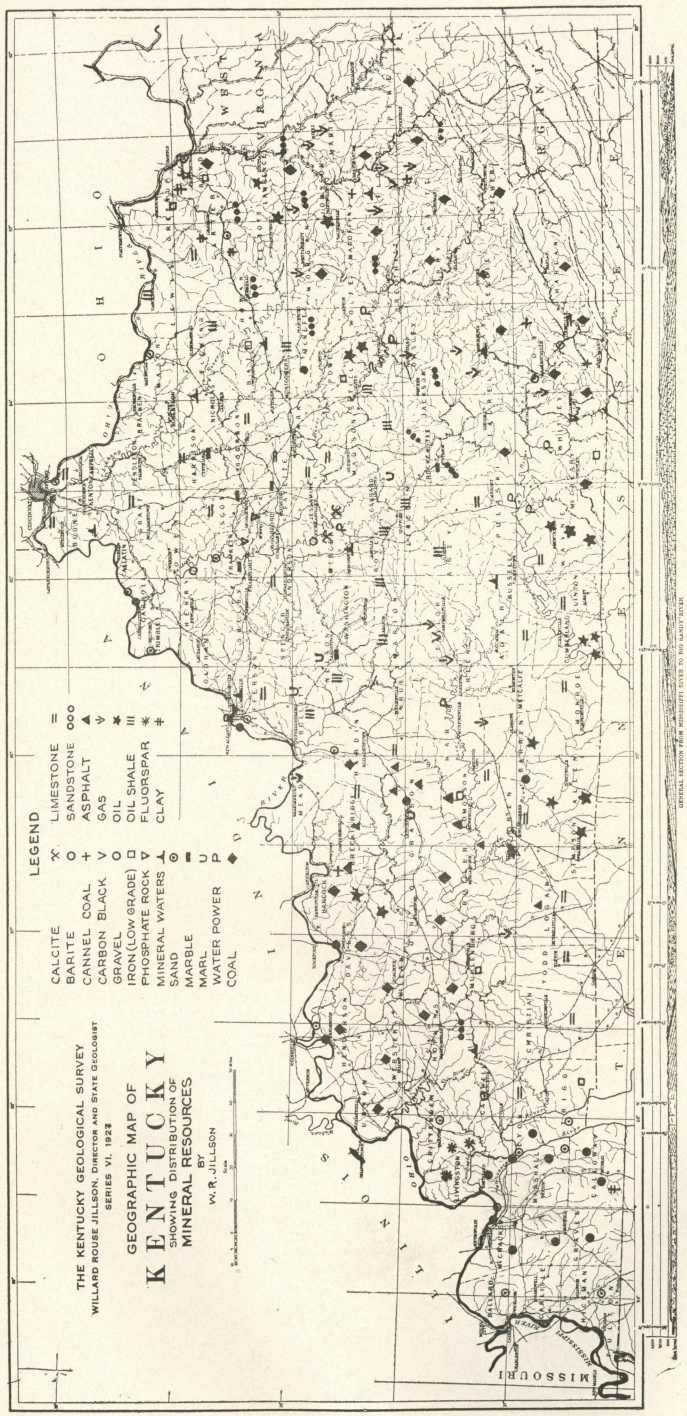
These unusual gray green clay-shales come to outcrop only in the central Bluegrass. Although they are thin they have been the subject of much inquiry. Their outstanding characteristic is their water absorptive qualities.

STATISTICAL SUMMARY OF KENTUCKY'S MINERAL RESOURCES†

CALENDAR YEAR OF 1924

Name	Volume	Value
Asphalt (Natural Rock)	274,743 tons	$2,386,557.00
Carbon Black	10,135,435 lbs.	488,533.00
Clay (Raw)		500,349.00
Clay Products		7,519,239.00
Coal*	43,387.732 tons	88,745,968.00
Coke‡ (beehive and by-product)	559,711 tons	2,798,555.00
Fluorspar	47,847 tons	988,940.00
Gasoline (from Nat. Gas)	7,274,000 gal.	769,000.00
Gravel	2,641,415 tons	1,039,417.00
Iron (Pig)	99,055 tons	2,127,682.00
Lead	175 tons	28,000.00
Lime	8,091 tons	58,228.00
Mineral Waters‡	210,367 gal.	33,050.00
Natural Gas	12,875,000 M. Cu. Ft.	3,432,000.00
Petroleum	7,407,000 barrels	14,592,000.00
Sand	783,132 tons	565,652.00
Stone	2,173,700 tons	2,786,249.00
Zinc	492 tons	63,960.00
Miscl. (Abrasives, Artificial Gas, Barite, Calcite, Portland Cement Materilas, Mineral Fertilizers, Phosphate Rock, etc.)		5,833,023.00
Total		$134,756,402.00

†Principally from U. S. Survey, and U. S. Bureau of Mines.
*Report of State Mine Inspector.
‡Figures for coke and mineral waters in 1923. Figures for 1924 not available.



DISTRIBUTION OF KENTUCKY'S DEVELOPED MINERAL RESOURCES

STATISTICAL SUMMARY OF KENTUCKY'S MINERAL RESOURCES†

CALENDAR YEAR 1925

Name	Volume	Value
Asphalt (Native Rock)	286,850 tons	$2,500,000.00
Carbon Black	7,309,378 tons	372,067.00
Clay Products		7,973,977.00
Coal	54,687,932 tons	89,404,450.00
Fluorspar	44,826 tons	833,794.00
Gasoline (from Nat. Gas.)	10,000,000 gals.	1,060,000.00
Gravel	1,495,537 tons	960,120.00
Iron (Pig)	153,935 tons	3,640,584.00
Lime	9,433 tons	71,300.00
Natural Gas	14,275,000 M. Cu. Ft.	4,282,500.00
Petroleum	6,658,803 bbls.	15,290,167.00
Sand	907,445 tons	810,338.00
Stone	1,703,010 tons	2,127,504.00
Miscellaneous Undertermined Resources* (Abrasives, Artificial Gas, Barite, Calcite, Clay, Coke, Lead, Mineral Fertilizers, Phosphate Rock, Zinc, etc.)		13,100,000.00
Total		$142,426,801.00

†Principally from U. S. Geol. Survey, and U. S. Bureau of Mines.
*Estimated by writer.

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